Concrete and H2S Gas in Wet Wells and Tanks

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What can H2S Gas do to Concrete?

- ?????????
Ho Chunk WWTP

- Influent Wet Well Recoating Project
Influent Wet Well

- MSA Professionals put the project out for bid in July 2015

- The low bidder was Badger Specialty Coatings

- Badger was awarded the project.
History

- The wet well was coated during the original construction with a Sika protective coating system.
- Through the years the coating system began to fail.
- The project had been budgeted for recoating and it was time to move forward.
Existing Conditions
Existing Condition

Because the protective coating system had failed, the H2S Gas had started deteriorating the concrete structure.

The existing protective coating system was beyond repair.
Concrete contaminated by H2S gas typically can have a PH of 4 or less.

The upper portion and ceiling of the wet well had contaminated concrete.
The Normal Range of Concrete is a PH 11-14

Why is it so critical to achieve a minimum PH of 10 or greater on a concrete rehab project?
Concrete with a low PH

Concrete in a low PH state is corroded, weakened, unsound and is in a un-coatable condition.
How do you raise the PH of contaminated concrete?

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Surface Preparation

- High Pressure Water Blast
- Dry Abrasive Blast Cleaning
Concrete Surface Preparation Requirements

SSPC SP-13
Abrasive Blast Cleaning
10,000 PSI High Pressure Water Blasting
Achieve a PH of 10 or greater
Achieve Less than 3 PPM in soluble salts
Concrete Repair – ABC & Coat the Rebar
Crack Repair – Epoxy Injection
Active Leak Repair – Grout Injection
3 Enemies of a Successful Coating Project in a H2S Gas Environment

- 1. Moisture in the Concrete
- 2. Low PH in the Concrete
- 3. Soluble Salts in the Concrete
ASTM D4263

- Concrete Moisture Test.

- Tape a piece of 3’ x 3’ plastic with strong duct tape to the concrete surface to be coated.

- Let it sit for a 24 hour period.

- If condensation has formed on the back side of the plastic – IT IS NOT SAFE TO COAT.
Concrete should have a PH reading of 10 or greater prior to apply protective coatings.
Simplified Pourbaix Diagram for the Iron Water System

- Corrosion (Fe+)
- Passivation (Fe₂O₃)
- Immunity (Fe)
- Corrosion (FeO₂H⁻)

Electrode Potential $E$, volts

- [Fe++] increasing above $10^{-6}$
- [Fe++] = $10^{-6}$
- [Fe++] decreasing below $10^{-6}$

pH of Solution

- Increasing Acidity
- Increasing Alkaline
- Neutral Solution
Laymen’s Theory

Concrete in a low PH state is corroded, weakened, unsound and is in an un-coatable condition.
Soluble Salts

- Definition: An ionic chemical compound that dissolves in water to form a solution of positive and negative ions.
Soluble Salts < 3 pmm

- Why is it so critical that we reduce the soluble salts on the concrete substrates that we are trying to protect with specialty coatings?
To Prevent Coating Failures
Soluble Salts Causes Osmotic Blistering

Definition: Osmotic blistering is a chemical reaction where two substances attempt to reach equilibrium. Water will flow from one solution to another, trying to create equilibrium.
Impervious top coat

Salts in solution

Damp concrete substrate

Defects in Primer acting as semi-permeable membrane
Soluble Salt Removal

- Chlor*Rid is a proven soluble salt removal in concrete and steel.

- Once the soluble salts are removed from the substrate salt blisters should not form in the new protective coating.
Coating Solution

- Specify a proven protective coating system that has had a long history of protecting concrete in H2S gas environment.
Coating Specifications

Tnemec Series 218 to Minimum thickness of 1/8 thick

Tnemec Series 436 Perma-Shield FR @ 125 Mils DFT
Protective Coating

- Apply Tnemec 436 Perma-Shield @ 125 Mils DFT
Holidays

- What are they?
Holidays

- Pinholes or voids in the coating system.

- Pinholes and voids need to be repaired prior to returning your wet well back into service.
Holiday Testing

- 20 Mils of coating or less utilizes low voltage holiday testing with the wet sponge method.

- 20 mils or greater require high voltage holiday testing
High Voltage Holiday Test

- After all the coatings have been installed correctly a High Voltage Holiday Test should be performed.
- 100 Volts per mill of coating.
- 125 Mil system will test at 12,000 Volts.
- Holidays and pinholes will be marked for repair by the inspector.
- Contractor is required to repair the holidays.
Fond du Lac WWTP Clarifier Project

- Primer: 20 Mils of Versaflex VF 20 Primer
- Finish: 100 Mils of Versaflex FSS 45 DC Polyurea
- 5 Years – No Failures
What Does Dixon Engineering do?

- Rehabilitation Engineers
- Structural Analysis
- Maintenance Inspections
- Corrosion Evaluations
- Certified Weld Inspections
- NACE Certified Coating Inspections
- Expert Witness for Coating Failures
Wastewater Infrastructures

- Inlet Chambers
- Bar Screen areas
- Clarifiers
- Digesters
- Wet Wells
- Aeration Basins
- Tunnels
- Pipes
- Screw Pumps
Questions

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